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Investment Decisions in a Water Market

The West is struggling with a water problem. Growing urban populations and mounting concern about the environmental effects of water use have focused attention on the problems inherent in the administrative control of water allocation.

An earlier *Letter* (Schmidt, 91-11) presented arguments for using more market forces in allocating water in California. Because market prices reflect the value that users place on the resource, individuals are better able to adjust their behavior in the least-cost way to put the water to its best uses. In contrast, administered allocations often are unable to create individual incentives that are consistent with social values. Economists advocate giving more control over water delivery to the private market, while keeping in mind the government's role in defining and enforcing property rights and environmental standards.

Although economists almost uniformly point to the lack of a market-oriented system for water in California as the source of bottlenecks and inefficient use patterns, policymakers are a good deal less enthusiastic about the creation of a water market. One major reason for their reluctance stems from concern about how a market would determine infrastructure investments—investments that traditionally have caused large public debates, such as the bitter political battle over the construction of a peripheral canal in California. In this *Letter,* we attempt to illustrate how a private market would determine infrastructure investments by applying the analysis to a proposed project in the Sacramento/San Joaquin Delta region of California's water system.

The setting and the issues

The Delta region lies in the center of California's extensive water system, covering much of the area between Sacramento, Stockton, and San Francisco. Through the state-operated State Water Project and the federally operated Central Valley Project, large volumes of water from storage facilities in the northern Sierra Nevada range and from Lake Shasta pass through the Delta region to be pumped to users south and west of the Delta.

Interest in new water transfer facilities has emerged for several reasons. One is concern about water quality. Water entering the Delta is free of most foreign matter, containing less than 50 parts per million of dissolved salts. After passing through the peat bogs and agricultural runoff that occurs in the Delta, water quality deteriorates significantly and dissolved salt concentrations can be many times that of the water entering the Delta. Recent problems have emerged in some areas, where dissolved salts have reacted with chlorine to form trihalomethane, a potential cancer-causing substance in the water, and salinity levels have begun to reduce agricultural yields.

In addition, pumping stations in the south part of the Delta can worsen water quality drastically. During periods of low flow and high demand, the pumps can cause "reverse flow," in which salt water from the San Francisco Bay is pulled into the Delta by the force of the pumps. The pumps also can do ecological damage, because they can trap and kill large quantities of marine life.

Another problem with the current system is the danger of earthquake damage. A major earthquake could destroy the Delta's levee system and much of California's water supply for a considerable period of time. Because the land in the region has subsided following the construction of the levees, an earthquake that destroyed the levees could cause water from the San Francisco Bay to fill much of the Delta, forming a large salt water lake in the middle of the state's fresh water supply system.

The Delta region has been at the heart of the ongoing debates about water policy in the state. A peripheral canal approach was (and continues to be) supported by interests largely in the south part of the state, and opposed by interests in the north part of the state that fear that such a system would make it possible for southern California to acquire more water at the cost of destroying the fragile Delta environment. In 1982, after a bitter campaign, California voters defeated Proposition 9, which would have provided funding for the construction of a peripheral canal. The canal would have diverted water from the Sacramento River around the Delta, ultimately delivering it to the pumping stations south of the Delta. The project would have called for releases from the peripheral canal to each of the tributaries to the Delta to maintain water quality.

The defeat did not kill the issue. In 1984, Governor Deukmejian proposed a more modest project to achieve the same goal. It, too, was defeated in the legislature. Nevertheless, the current five-year drought has helped spark other plans for building such a facility. Among these is a proposal to create storage facilities south of the Delta to address the problems created by reverse flow and salinity. By creating a storage facility, water can be shipped through the Delta at times when flows are high (and demand is low), and water could be drawn from the reservoirs when flows are low and demand is high. Regardless of the specifics, however, any such project would require public funding and public support in the current framework of administrative water allocation in the state.

A market approach
If water were traded in a market, the set of choices would be enlarged. Market-determined prices for water would provide private decision-makers the incentives to consider investing in new facilities. For example, if water is in greater demand during summer months, prices will be relatively high. If prices for water are considerably lower during other times of the year—because demand is lower—it may be worthwhile for investors to consider building facilities to draw and store water when prices are low to avoid higher priced water when demand is high.

Using a market to price water does not obviate government's role in the process. To protect the state's public interest, the state must intervene in the market in at least two areas. First, it must limit water shipments through the Delta to quantities that protect the region's environmental quality. In any market system, it is necessary to establish and enforce environmental baselines. Second, the state has the responsibility to ensure that new facilities do not have detrimental social costs that are not fully compensated.

To achieve those goals, the state would not allow excessive pumping during periods of low flow, while it would allow more activity during periods of high flow. As a result, during periods of low flow water would be more scarce. Achieving the second goal requires strict adherence to the environmental impact assessment process.

In response to this set of government policies, private investors or their agents (such as water agencies) might have an incentive to build new storage facilities. Since changes in the scarcity of water would lead to seasonal price swings, the system would generate incentives to smooth those price fluctuations. One response would be for large water districts south of the Delta, individually or jointly, to build storage facilities to minimize their cost of acquiring water. A decision to build the facility could be made on economic grounds, taking into consideration the benefits—avoiding high costs during the peak summer demand—and the costs of constructing the facility—including costs of complying with the environmental impact process. Furthermore, if a facility made economic sense, water districts might find it advantageous to finance such projects, rather than depending on state funding.

Other agents also would be encouraged to adjust their water use practices. Water districts north of the Delta might build storage facilities if they found they could profit by selling the water when prices were higher, thereby increasing water availability at times when demand is high. Moreover, individual farmers that buy water might find it cheaper to buy more water in the spring months to put into storage (including holding tanks or ponds) for the summer months, again avoiding the higher cost in the summer. Finally, farmers (and other consumers south of the Delta) would be encouraged to find ways to conserve on water use, particularly during periods when costs were high, such as during the low-flow periods.

Water quality and reliability
While new storage facilities might help improve water quality, other alternatives may also be evaluated by the market. For example, a small peripheral canal might prove cost-effective to transfer higher quality water to the San Francisco Bay customers, or to provide higher quality water to blend with Delta water shipped to the south part of the state. The cost of such a system would be borne by the consumers of the higher quality water, if they were willing to pay for construction.

Approaches such as these would not threaten the environment. The state could continue to enforce environmental quality standards throughout the water delivery system, so potential diversions would not exceed the levels needed to sustain the Delta's ecosystem. Under such a system, water prices would vary to reflect availability.

Concern about reliability in the event of an earthquake also could be addressed more easily in a market setting. Costs of building a peripheral canal could be balanced against efforts to reinforce existing levees and Delta facilities. With benefits reflected in prices for water, it is possible to measure the relative benefits and costs of alternative approaches by projecting the impact of various disasters on the resulting market price—calculations that are not that different from those used by the insurance industry to determine catastrophic insurance premiums.

Advantages of a market

Several advantages of a market are apparent in these approaches. First, and most importantly, a market creates incentives to solve problems at the lowest cost. By facing all market participants with the private cost of using water, they can make rational choices about use patterns. Unlike administered approaches, a market encourages innovation. Consumers, both agricultural and urban, find appropriate ways to conserve.

Second, the timing problem of water delivery is mitigated by the potential for corresponding price movements. Since prices would reflect seasonal variations in supply, both suppliers and consumers would have incentives to find ways to adjust their storage and use behavior to reduce their total water costs. Large new reservoirs or transfer facilities still may be cost-effective, but the ultimate size needed may be considerably smaller than would be indicated by today's use patterns that result from pricing that ignores relative scarcity.

Third, markets also can encourage the development of new facilities that are consistent with environmental quality concerns. Since the state would be required to reserve sufficient quantities of water to assure environmental quality standards, financial decisions to build a new facility would be made conditional on those standards. That is, investments would be judged on the basis of market prices for water that take as given the amount reserved by the state to achieve standards. Prices would reflect the relative scarcity of the residual water supplies.

Finally, market-based solutions possess the desirable characteristic of being self-funding. While the state might build new facilities, there is no reason why the state needs to take the lead. New storage facilities could be constructed by individuals, water districts, or combinations of such investors. Moreover, payment for the facility could come directly from the beneficiaries of the projects, and there would be little need to burden taxpayers with costly water projects.

Conclusions

Changing to a water market would involve fundamental changes in the way investment decisions are made. Markets do not preclude new water projects. Rather, unlike the present system, market discipline would require a potential project to be justified on financial grounds. Moreover, prices that emerge in a market aid this process significantly by providing good estimates of the potential value of a given project.

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